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Abstract

The effective governance of organizational capabilities in the areas of Service Management and Service-oriented Architectures (SOA) has been broadly recognized as an essential success factor for service-oriented enterprises. Organizations that target the adoption of an adequate Service Governance approach face the difficulty of selecting from a variety of related frameworks with differing scopes and objectives. In this paper, we provide a structural comparison of the major, non vendor-specific IT and SOA Governance and Management frameworks and use this comparison to validate our own Service Governance meta model. This generic meta model is intended to provide a sound conceptualization, thereby contributing to a better understanding and facilitation of Service Governance, e.g. by forming the foundation for the development of a flexible and configurable Service Governance tool.

Keywords

SOA Governance, conceptual model, meta model, comparison, validation.

INTRODUCTION AND RESEARCH APPROACH

For many years now, IT has been seen as an integral and essential part of a company's operations. It is claimed that inadequate management of the dynamically evolving IT infrastructures can impede future strategic intentions. This necessitates IT governance as a key tool to prevent unnecessary IT investment and to ensure the strategic alignment of business and IT (Musson and Jordan 2006). More recent developments in the area of IT technologies and architectural approaches, such as the move towards service-orientation, pose new challenges with regard to governance. Although service-orientation and particularly the concept of Service-oriented Architectures (SOA) have already passed the crest of hype and excitement five years ago and subsequently went through the valley of disillusionment, recent trends indicate that they now slowly increase in importance as they are recasting the business models of major enterprise vendors such as SAP and ORACLE and form the foundation for the enablement of other developments such as cloud computing, loosely coupled businesses, real-time event processing and emerging analytical organizations. At least conceptually, the unique combination of expected service-orientation benefits from both the IT perspective (e.g. reduced development and maintenance costs, faster IT response to business change, better quality through service reuse, etc.) and the business perspective (e.g. business agility, reduced time to market, right-sized business model, etc.) is still valid. However, for organizations to be able to materialize these benefits and to succeed with SOA, understanding and implementing effective Service and SOA Governance has become a corporate imperative (Marks 2008).

Research that supports organizations in improving their capabilities in the areas of Service Management and SOA Governance is therefore highly relevant, particularly against the background that the lack of a comprehensive governance approach has been cited as the most common reason for failures of post-pilot SOA projects (Malinverno 2006). Adequate SOA Governance, according to The Open Group (2009a), has to define which decisions need to be made to have effective governance, who should make these decisions, how these decisions will be made and monitored, and what organization structures, processes, and tools should be deployed in the organization. However, as it is the case with many IT and business related concepts, there is no agreed upon common understanding of what constitutes Service or SOA Governance, so that we proposed the following working definition in an earlier publication (Janiesch et al. 2009a), which draws from definitions in Bernhardt and Seese (2008) and Dodani (2006):

> ***Service or SOA Governance*** focuses on the decisions across the entire service lifecycle to enable organizations to realize the benefits of an SOA. It is an approach to exercising control and mitigating risk by establishing organizational structures, processes, policies, and metrics suitable to

> ensure that the adoption, implementation, operation, and evolution of an SOA is in line with the organization's strategies and objectives and complies with laws, regulations, and best practices.

Many enterprises presently face the challenge of developing adequate governance mechanisms for an SOA, which introduce new complexities due to the amount of services to be managed. The decomposition of today's business applications into reusable business process components that may be marketed to external customers creates novel challenges for IT governance. The adoption and implementation of an effective SOA Governance approach is certainly not an easy task, but the knowledge bases of Corporate and IT Governance and Management, including well-established governance and management models such as the Control Objectives for Information and Related Technology (COBIT) (IT Governance Institute 2007) and the IT Infrastructure Library (ITIL) (Office of Governance Commerce 2007) as examples, form obvious points of reference for the derivation of a SOA Governance framework. Some authors view SOA governance as a *subset* (Webmethods 2006), others call it an *extension* (Holley et al. 2006) or "specialization" (Schelp and Stutz 2007) of IT governance. However, organizations typically require customized approaches or even the deployment of multiple frameworks at different organizational levels, depending on various factors such as their size, existing structures, objectives, levels of SOA maturity etc.

To support organizations in their process of establishing an effective and individualized SOA Governance regimen, we have outlined in previous work a Service or SOA Governance framework adoption and implementation process that includes the assessment of an organization's as-is state, the selection of relevant components from potentially multiple related IT and SOA Governance and Management frameworks, the customization of these framework components to the organization's specific needs and the definition of a feasible roadmap towards the delivery of the required or desired level of governance (Janiesch et al. 2009a). This process was underpinned by a conceptualization in the form of a generic meta model that integrates the structure of existing IT and SOA Governance frameworks into one view and can serve as a basis for the design and implementation of a tool that facilitates multi-level, multi-framework customization of major IT and SOA Governance and Management frameworks to derive a tailored Governance framework for organizational aspects of Service or SOA Governance.

The SOA Governance reference framework partly presented in this paper is a *design artifact* in the sense of the design science-based approach to IS research as described in Hevner et al. (2004). IS research accordingly is concerned with two design processes, i.e. to *build* purposeful artifacts to address heretofore unsolved problems, and to *evaluate* these artifacts with respect to the utility provided in solving those problems. Starting from the existing knowledge base in the build phase of the proposed SOA Governance framework, we analyzed the widely-used IT governance frameworks COBIT and ITIL and provided an initial evaluation of its utility in a case study and collected further input through expert interviews in order to derive the core of the SOA Governance framework. While we briefly summarize our earlier work on the meta model below, the focus and main contribution of this paper lies in the comparison of the major, non vendor-specific IT and SOA Governance and Management frameworks based on the structure imposed by the meta model and the empirical validation of the meta model in the course of this exercise. Thus, we not only present an overview of the structural features of the existing frameworks, which can be very useful for decision makers in framework selection processes, but we also validate the elements of our meta model against the concepts that occur in the existing approaches.

The remainder of this paper is structured as follows. We begin by reviewing the related literature about IT and SOA Governance, conceptual modeling of governance frameworks and current software support for SOA Governance. The next section of the paper will then present an overview of our proposal for a governance meta model that is derived from existing IT Governance and Management frameworks as well as from empirical insights gained through interviews with consultants from a large ERP vendor, an Australian government agency, and a major Australian retailing company. The main part of the paper is dedicated to the structural comparison of the major vendor-neutral IT and SOA Governance and Management frameworks, using the proposed meta model as a foundation for the comparison criteria. The paper concludes with a summary and an outlook to future work.

RELATED WORK

There are a significant number of frameworks for IT Governance and Management that have been published and/ or standardized in recent years by industry consortia, standardization bodies and academia with varying degrees of diffusion and diverse foci on different aspects of IT Governance and Management relevant to organizations. Most prominent examples include ITIL, COBIT, ValIT, and ISO/IEC 20000.

ITIL, for example, is an IT Management framework that primarily defines management and support processes (Office of Governance Commerce 2007). ISO 17799 has a much narrower focus revolving around security management (International Organization for Standardization 2006) and is rather complementary than contradictory to ITIL. COBIT, on the other hand, can be classified as a high level governance and control framework that is less targeted towards operational issues but is rather more tightly aligned with the business

objectives of an organization (IT Governance Institute 2007). COBIT has practically become the global de facto standard for IT control, and most frameworks somewhat align with. While ITIL primarily addresses IT efficiency that relates to the effective operation of IT, COBIT is primarily addressing effectiveness and strategy of IT in the context of an organization, where effectiveness relates to producing a decided, decisive, or desired effect and strategy relates to the strategic planning and adaptation (e.g. of structure or behavior) that serves the core function of IT to contribute to desired business outcomes (Knahl 2009).

ITIL provides a description of a number of important IT best practices with process definitions, role descriptions and realization guidelines, which can be tailored to any IT organization to improve efficiency of the IT service provision. Neither organizations themselves nor IT management systems can be certified as ITIL-compliant (Knahl 2009). Yet, organizations that base the provisioning of IT services on ITIL can seek compliance and achieve certification under the international IT Service Management standard ISO/IEC 20000, which builds upon established IT Service Management best practice contained within the ITIL framework.

ValIT, produced by the IT Governance Institute (2008), is a formal statement of principles and processes for IT portfolio management that provide a framework for the governance of IT investments. Capability Maturity Model Integration (CMMI) can be described as an approach focused on process improvement across projects, divisions, or entire organizations that helps organizations improve their performance (Software Engineering Institute 2009). The Open Group Architecture Framework (TOGAF) is an enterprise architecture framework that provides a comprehensive approach to the design, planning, implementation, and governance of an enterprise information architecture (The Open Group 2009b).

In the context of Service and SOA Governance, The Open Group has specified a standardized SOA Governance Framework that describes the governance activities impacted by an SOA and puts forward some best practice governance rules and procedures for those activities (The Open Group 2009a). Although very promising, the framework is still emerging and has several shortcomings. For example, it lacks a sound ontology to relate the core governance elements to each other and does not specify detailed accountabilities along the service lifecycle, which would be of very practical use for most organizations implementing SOA Governance.

Not only industry consortia and standardization bodies are active in advancing the field of Service and SOA Governance. There are also a relatively large number of approaches that have been published in the form of white papers by software companies whose main focus is to sell related software tools. Many of these approaches emphasize specific aspects of SOA Governance, such as change management or service design, instead of providing a holistic view. As Janiesch et al. (2009b) and Niemann et al. (2008) point out, many of them lack framework scope and are often driven by own market interests.

An example of related work from academia is the paper by Bernhardt and Seese (2008) who propose a conceptual SOA Governance framework that aims at covering the complete SOA lifecycle. In contrast to other approaches, which use IT Governance and Management frameworks as a starting point for the derivation of a specialized SOA Governance framework, Bernhardt and Seese (2008) have base their proposal on an analysis of the standardized OASIS SOA Reference Model (MacKenzie et al. 2006) to identify governance needs in a SOA context. Focusing on management, Knahl (2009) presents the results of a case study that aims at illustrating the adaptation of best practice frameworks and the challenges and opportunities for holistic IT Management to facilitate Service Management and IT Governance. The goal is to propose an integrated management architecture based on the integration of IT Infrastructure Management, IT Service Management, and IT Governance. Goeken and Alter (2008) promote the use of meta models to represent IT Governance frameworks, which is similar to the approach taken in this paper. However, we attempt to derive a unified, comprehensive, and integrated meta model for Service and SOA Governance by integrating multiple frameworks, which can then serve as the basis for a Governance tool across frameworks. Their aim is to compare the conceptualization of individual models and possibly allow their association to each other on a one by one basis. They use the widespread COBIT Governance framework as an example to show how a conceptual meta model can be used to establish a theoretical foundation, formalize such frameworks and provide a means for analyzing them and for representing them in application systems and tools. Finally, the COMPAS project, which is funded in the context of the 7th Framework Programme of the European Commission, has a dedicated focus on service compliance and targets the design and implementation of novel models, languages, and an architectural framework to ensure compliance of services to design rules and regulations.

A comprehensive and unified view on Service and SOA Governance still is a gap in the related literature, as most of the work so far has been patchwork. The model we validate is primarily derived from and validated against the much wider area of successful IT Governance and Management frameworks in order to leverage existing knowledge and revise it against the background of SOA-specific characteristics. A detailed comparison of the extant approaches helps validate the model and, as a side effect, gives a useful overview of their major structural features.

A GENERIC SERVICE GOVERNANCE META MODEL

Overview

As argued above, most existing frameworks or approaches focus on a specific aspect of governance. Thus, it is important to have a consolidating overview of the constituent parts and their interrelationships. Prior analyses identified three major areas of concern (Janiesch et al. 2009a): Processes, roles and other essential attributes (Part A), views and indicators (Part B), company-specific information (Part C). The resulting meta model has undergone an evolution based on the consideration and integration of first empirical insights gained through the validation of an earlier version of the meta model in six interviews with SAP consultants in Germany as well as the Asia-Pacific region, two two-day workshops with a Western Australian government agency, and a phone interview with the Manager, Competency Centres Design, of a major Australian retailer.

Figure 1 provides an integrated view on the above parts and slightly improves the prior state of the art. While Part A comprises the essential constructs of any governance framework, Part B includes constructs to further classify governance processes. These are non-essential attributes which add value to the framework but are not indispensable for an operationalized SOA governance model. Part C includes company-specific information which must be included when operationalizing the framework. So, Part C is not part of a framework as such but provides the necessary alignment to the overall corporate governance. It is important to relate a governance framework blueprint to company facts in order to properly operationalize it. These three clusters are linked to each other. Also, we have to acknowledge that in principle every construct should be applicable recursively. I.e., a tool can be composed out of different individual tools, for example, or one layer of phases might not be sufficient. For the sake of simplicity, however, we only included this requirement in the meta model for constructs for which nestability seems crucial.

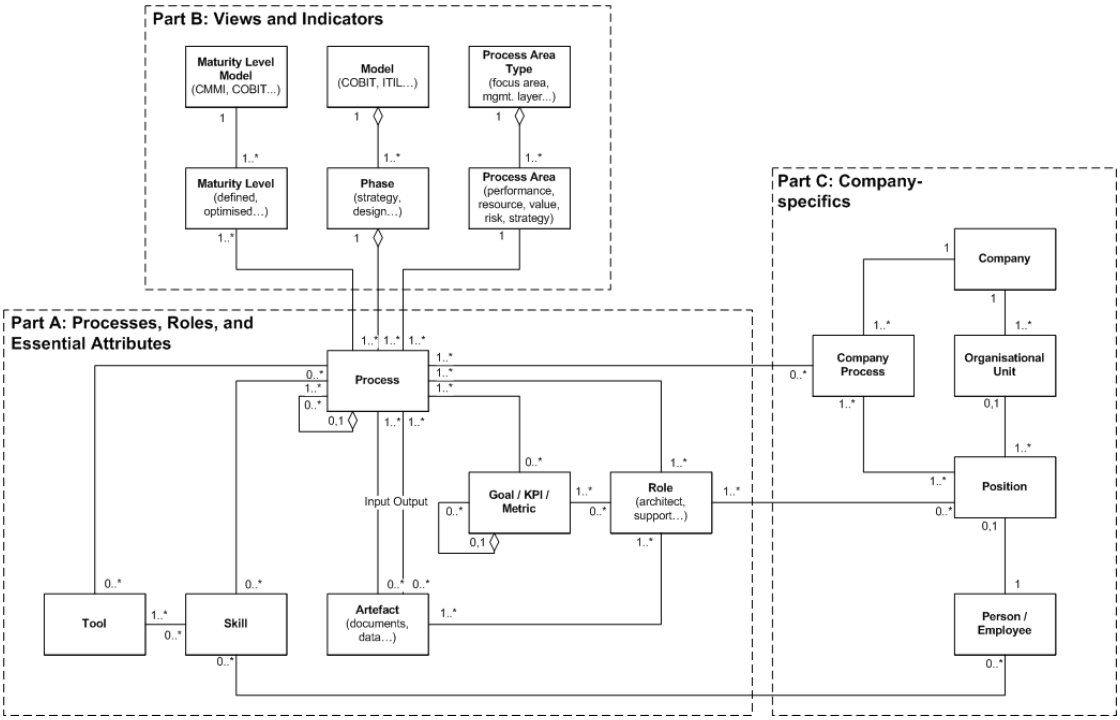

Figure 1: Integrated View on Governance (cf. Janiesch et al. 2009a)

The core of this framework is the process. Processes, also termed tasks or activities, in governance frameworks de-/prescribe procedures to ensure the desired operation of an organization (and its IT or SOA in particular). Processes consist of subordinated processes which in turn might be composed of sub-processes. Each process is linked to a number of roles which use and create artifacts as inputs and outputs of the performed tasks. Consequently, it is necessary to unambiguously define roles as well as their rights and competencies. Artifacts comprise all sorts of documents, such as status updates, roadmaps or architecture diagrams. Artifacts in a wider sense include further items such as data or code. While one may argue that compliance requirements should be represented in an entity of its own such as regulation, we consider it to be part of artifact. Ultimately, every regulation is a document which serves as guidance (i.e. input) for a task. Each process has key performance indicators (KPI) or goals. These are calculated or derived from metrics that are collected through monitoring. KPIs as well as goals can be composed of different individual objectives. Processes are executed using tools. These can be as simple as pen and paper but nowadays more commonly involve software. Each process and tool requires certain skills to be properly executed.

As there are usually a large number of processes to consider, it is important to classify and structure processes in order to make them manageable. Most commonly, processes are grouped in phases. Usually, the phases are aligned with the lifecycle of the governance framework's objectives. Thus, phases can be regarded as the primary structuring characteristic to create views on a framework. Consequently, the governance or management model as such is related to its processes through phases. Processes can be structured in many areas to create more manageable views. Process area types can include focus areas, management layers, or capabilities. Maturity models are a means to measure the maturity of a system concerning a structured set of aspects. Most maturity models distinguish five maturity levels (initial, repeatable but intuitive, defined, managed and measurable, optimized) (IT Governance Institute 2007; Software Engineering Institute 2009). Capability profiles may be linked to maturity models. They represent the application of the model on a system and outline the overall abilities of the system compared with the planned targets.

In order to apply a governance framework to an individual enterprise, governance roles need to be matched to company-internal structures. Simplified, a company consists of several organizational units in which several positions are available. An employee of the company, an individual person, holds one of these positions and is involved in the execution of company processes. Each position can correspond to one or multiple roles in the governance framework. Accordingly, an employee is involved in the execution of governance processes in one or even multiple roles. In general, the meta model understands company processes as (to-be) governed business processes that provide business value and realize business objectives. However, for benchmarking purposes the company processes can also represent a company's governance processes which are then put into relation with the state-of-the-art.

COMPARISON OF SERVICE GOVERNANCE FRAMEWORKS TO META MODEL

In order to validate our generic service governance meta model, we map it against the major extant vendor-neutral frameworks for IT and SOA Management and Governance, which have been briefly characterized in the section about related work. In the following, we will compare these frameworks using the structure that is imposed by our integrated view on governance, thereby not only providing a useful and concise overview of core structural features of the existing approaches, but also validating the elements of our meta model.

The following table summarizes the focus of each of the frameworks we use for comparison and validation. We selected the frameworks after screening the efforts of all major standardization bodies and expert interviews. We consider the selection to be exhaustive for our cause.

Table 1: Governance Frameworks for Comparison and Validation

Framework	Summary	Reference
COBIT 4.1	COBIT provides good practices across a domain and process framework and is focused more on control, less on execution for IT Governance.	(IT Governance Institute 2007)
ITIL v.3	ITIL is a widely accepted approach to IT Service Management. It provides objectives, decisions, plans, policies, and strategies for senior managers.	(Office of Governance Commerce 2007)
OpenGroup SGF	The SOA Governance Framework defines a reference model and a vitality method to assist organization the impact of SOA on governance.	(The Open Group 2009a)
TOGAF 9	TOGAF is a framework for developing an enterprise architecture.	(The Open Group 2009b)
CMMI-SVC 1.2	CMMI models are collections of best practices that help organizations to improve their processes. CMMI-SVC focuses on service provider processes.	(Software Engineering Institute 2009)
ValIT 2.0	Val IT complements COBIT from a business and financial perspective.	(IT Governance Institute 2008)
OASIS SOA 1.0	The OASIS reference architecture provides an abstract template upon which a SOA concrete architecture can be built.	(Organization for the Advancement of Structured Information Standards (OASIS) 2009)
ISO/IEC 20000-1	SO/IEC 20000-1:2005 defines the requirements for a service provider to deliver managed services.	(International Organization for Standardization/ International Electrotechnical Commission (ISO/IEC) 2005)
TEXO v1	The TEXO Governance Framework provides a collection of best practices and extensions to that for governance in the Internet of Services.	(Janiesch et al. 2009b; Janiesch, Niemann 2010)

For the comparison of these frameworks, we use the parts and elements of our generic meta model as criteria. However, none of the analyzed frameworks includes company-specific aspects as captured in Part C of our meta model. Therefore, the following two tables present only details about framework elements related to Part A and Part B.

The analysis showed that the specification of *processes* (or activities, actions, tasks, steps) constitutes the core of any governance framework. It is the only aspect that can be found in all frameworks. As Table 2 points out almost all frameworks also provide some sort of structuring for the processes to group them in different phases. Only the

Open Group's Service Governance Framework includes two models, a reference model with best practices and a method-centric model that is supposed to assist with the actual implementation. As for the rest of the frameworks, only the TEXO Governance Framework hints at this but does not provide more than initial ideas. The amount of processes varies quite significantly as the less comprehensive frameworks only include a vague hint at processes and the more elaborate ones such as ITIL and COBIT basically consist of process descriptions.

Table 2: Governance Framework Comparison Based on Aspects Related to Part A (Processes, Roles, and Essential Attributes) of the Generic Meta Model

Meta Model / Aspect	COBIT 4.1	ITIL v3	OpenGroup SGRM	TOGAF 9	CMMI SVC 1.2	ValIT 2.0	OASIS SOA 1.0	ISO/IEC 20000-1	TEXO v1
Process	Process/ Control Objective (Activity)	Process/ Activity	SOA Processes (Solution Portfolio Management/ Service Portfolio Management/ Solution Lifecycle/ Service Lifecycle), Activity	Step	Practice (Specific/ Typical Work/ Sub-/ General)	Process (Activity)/ Practice	Action	Service Management Process	Process Area, Process, Task
Role	Function (RACI)	Role (RACI-VS)	Structure/ Key Role (Responsibility)	Stakeholder Group/ Stakeholder		Role (RACI)	Actor/ Stakeholder/ Participant/ Non-Participant Stakeholder/ Delegate, Role (RACI-like)	Role (RACI)	Stakeholder/ Role (RACI)
Goal/ KPI/ Metric	Goals/ Metrics	Goal/ Purpose/ Objective/ Critical Success Factors/ Key Performance Indicators	Metric		Specific Goals/ Generic Goals	Specific Goals/ Generic Goals	Goal/ CSF	Review	Vision/ Mission/ Strategy, Objective/ CSF/ Process/ KPI/ Measurement, Function
Artifact	Inputs/ Outputs	Trigger/ Input/ Output/ Interface, Method/ Technique	Input/ Output Process Artifact (Business Level/ Organizational/ Roadmap/ Description/ Process/ Policy/ Plan), Used Guideline	Input (Reference Materials External to the Enterprise/ Non-Architectural Inputs/ Architectural Inputs)/ Output (Catalog/ Matrix/ Diagram Deliverable), Techniques		Input/ Output	Intent/ Event/ Effect		
Skill		Skill/ Attribute/ Competency					Skill, Qualification		
Tool		CASE Tools/ Repositories	SOA Governance Technology	Tool					Analyzer, Builder, Manager, Monitor

Most frameworks also provide a *role*, actor or stakeholder perspective on these processes to manage accountabilities and responsibilities. Not all of them assign tasks to them. Most commonly, RACI matrices are used to manage the connection between role and process or capability.

Ontologically speaking, every process is a mereological sum of *events*. It is put into place to ensure a certain *state* or state-transition(s) (Masolo et al. 2003). Not all frameworks have explicated this distinction. Also, the measurement of a specific *goal*, capability or control objective is not always in focus. Furthermore, most frameworks do not elaborate on specific measures that can be used to monitor their processes. They acknowledge, however, that some sort of monitoring of governance processes is necessary. ITIL, COBIT, and TEXO (which is essentially based on the prior two) provide the most comprehensive overview also in terms of implementation and structure. OASIS provides a sound conceptualization.

Based on our meta model, we consider process, roles, and KPI to be the three the core aspects of any framework which should be specified in detail. In order to properly execute governance, we regard input and output artifacts such as documents, checklists, policies, and models, tools to support the above, and required skills to be able to execute in a particular role as important parts of a comprehensive governance framework. Not all compared frameworks cover these aspects due to the low level of detail some of the more generic frameworks have been specified in.

Concerning *artifacts*, COBIT, ITIL, and TOGAF are very comprehensive and detailed in specifying them while the Open Group's SOA Governance Reference Architecture names a number of artifact categories but does not include examples. Most of the other frameworks do not go into too much detail or do not refine their processes to this extent. Similarly, *skills* are hardly included in the frameworks, which makes the application of governance

inherently complicated as it is left to implementation managers to specify their requirements. The Open Group at least provides a method for rollout and TEXO provides prototypical tool support.

TEXO is also the only framework which suggests specific software *tools*. While none of the prototypes is publicly available at this stage, the framework acknowledges the complexity of governance rollout and management and proposes dedicated tool support rather than generic hints at word processors and spreadsheet software. TOGAF, for example, does not require or recommend any specific tool but includes a section on tool selection and standardization. Some vendor-specific frameworks that have not been included in the analysis mention tool support. A mature example outside this governance-focused analysis is the Implementation Assistant of SAP's AcceleratedSAP methodology (SAP AG 1999). It provides tool support for a complex implementation methodology including artifacts and timelines. While it does not provide any analysis capabilities as mentioned in TEXO, a similar approach can make administration work significantly more efficient.

Table 3a and 3b comprises views and indicators on the above constituent parts of a governance framework, most notably process areas, metric structures and maturity models.

Table 3a: Governance Framework Comparison Based on Aspects Related to Part B (Views and Indicators) of the Generic Meta Model (1/2)

Meta Model / Aspect	COBIT 4.1	ITIL v3	OpenGroup SGRM	TOGAF 9	CMMI SVC 1.2	ValIT 2.0	OASIS SOA 1.0	ISO/IEC 20000-1	TEXO v1
Model	Control Objectives for Information and related Technology	Information Technology Infrastructure Library	SOA Governance Framework	The Open Group Architecture Framework	Capability Maturity Model Integration for Service	Enterprise Value: Governance of IT Investments	Reference Architecture Foundation for Service Oriented Architecture	ISO/IEC 20000-1	TEXO Governance Framework
Phase	Domain (Plan and Organize, Acquire and Implement, Deliver and Support, Monitor and Evaluate)	Core Lifecycle (Strategy/ Design/ Transition/ Operation/ Continual Improvement)	Aspect (Planning/ Design and Operational/ Solution/ Service)	Phase (Architecture Vision/ Business Architecture/ Information Systems Architecture/ Technology Architecture/ Opportunities and Solutions/ Migration Planning/ Implementation Governance/ Architecture Change Management/ Architecture Requirements Management)		Domain (Value Governance/ Portfolio Management/ Investment Management)		Service Management Process Group (Service Delivery/ Relationship/ Resolution/ Control/ Release)	Lifecycle Phase (Design/ Deployment/ Delivery/ Monitoring/ Change)
Process Area Type	Information Criteria (Primary/ Secondary), IT Governance Focus Areas (Primary/ Secondary), COSO (Primary/ Secondary), IT Resources		Governing Process		Category	Focus Area			Process Status, TEXO Service Lifecycle
Process Area	Effectiveness,/Efficiency/ Confidentially/ Integrity/ Availability/ Compliance/ Reliability, Strategic Alignment/ Value Delivery/ Resource Management/ Risk Management/ Performance Management, Control Environment/ Risk Assessment/ Control Activities/ Information and Communication/ Monitoring, Application/ Information/ Infrastructure/ People		Compliance/ Dispensation/ Communication		Service Establishment and Delivery/ Support/ Process Management/ Project Management	Strategic Alignment/ Value Delivery/ Resource Management/ Risk Management/ Performance Management			Existing/ Extended/ New; Innovation/ Offering/ Matchmaking/ Usage/ Feedback

Processes constitute the core of all compared governance frameworks. Consequently, their structuring is of major importance for the manageability of the framework. All frameworks but CMMI and OASIS provide a main structure through *phases*, domains, aspects, or a lifecycle. The OASIS Reference Architecture Foundation does not due to the fact that the foundation in itself is a meta model rather than an instantiated framework. CMMI

structures its 24 process areas according to categories. While this provides some level of abstraction, its intention is not to create a hierarchy but a classification of process areas. Accordingly, we understand its categories to be a process area type.

Most frameworks provide a secondary structure (*process area type*) to classify processes. COBIT uses information criteria, IT Governance focus areas, COSO, and IT resources; The Open Group uses governing processes; ValIT refers to focus areas; and TEXO provides a processes status and also maps governance processes to the TEXO service lifecycle. Most frameworks provide comprehensive mapping tables to facilitate the creation of perspectives.

Key performance indicators and the definition of individual metrics are not as prominent as process definitions in the framework specifications. Consequently, there are fewer views to choose from than with the process counterpart (*KPI area type*). COBIT provides a distinction between business, IT, process, and activity KPIs, ValIT distinguishes accordingly: domain, process, and activity. TEXO provides a rather comprehensive scorecard view on individual metrics and provides support for different levels of abstraction similar to process phases. They also hint at structuring by control objectives (preventive, detective, corrective).

Most frameworks but the more recent ones of OASIS and The Open Group comprise *maturity models* and capability models. While most frameworks detail their own maturity model there is rarely any deviation from the generic CMMI proposal. Its commonly used levels are initial, managed, defined, quantitatively managed, optimizing. If capability profiles are included they also are closely aligned with CMMI. TEXO provides a method and tool to build capability profiles of existing processes and compare them to best practices and identify need for action. Becker et al. (2009) provide a comprehensive overview focusing solely on maturity models and propose a method for the development of maturity models.

Table 3b: Governance Framework Comparison Based on Aspects Related to Part B (Views and Indicators) of the Generic Meta Model (2/2)

Meta Model / Aspect	COBIT 4.1	ITIL v3	OpenGroup SGRM	TOGAF 9	CMMI SVC 1.2	ValIT 2.0	OASIS SOA 1.0	ISO/IEC 20000-1	TEXO v1
KPI Area Type	Performance Measurement								Measurement Framework, Control Objectives
KPI Area	Business (Financial, Customer, Internal, Learning and Growth)/ IT (1-28)/ Process/ Activity					Domain/ Process/ Activity			Company Scorecard/ IT Balanced Scorecard/ Scorecard of Strategic Business Unit, Preventive Control/ Detective Control/ Corrective Control
Maturity Level Model	Generic Maturity Model, Maturity Dimension, Maturity Attribute	Process Maturity Framework, Area		*Reference to Architecture Capability Maturity Model and Capability Maturity Model Integration*	Continuous Representation Capability Level, Staged Representation Maturity Level	VG/ PM/ IM Maturity Model			Maturity Model, Maturity Model Dimension, Capability Profile
Maturity Level	Non-existent/ Initial ad hoc/ Repeatable but Intuitive/ Defined Process/ Manageable and Measurable/ Optimized, IT Mission and Goals/ Risk and Compliance/ Return on Investment and Cost-efficiency, Awareness and Communication/ Policies Plans and Procedures/ Tools and Automation/ Skills and Expertise/ Responsibility and Accountability/ Goal Setting and Measurement	Initial/ Repeatable/ Defined/ Managed/ Optimizing, Vision and Steering/ People/ Processes/ Technology/ Culture			Incomplete/ Performed/ Managed/ Defined/ Quantitatively Managed/ Optimizing, Initial/ Managed/ Defined/ Quantitatively Managed/ Optimizing	Non-existent/ Initial ad hoc/ Repeatable/ Defined/ Manageable/ Optimized			Initial/ Repeatable but Intuitive/ Defined/ Manageable and Measurable/ Optimized, Technology and Architecture/ People and Organization/ Adoption Scope/ Process/ Standards/ SOA Development/ SOA Governance, Preparation/ Implementation/ Consolidation

On purpose, we did not include vendor-specific frameworks in this comparison as most of them are very specific to the vision/mission or offering of the vendor or simply because they lack framework scope and focus on a small fraction of a proper framework (Janiesch et al. 2009b). There are multiple vendor-specific frameworks available, some of them have quite a large scope, some of them are focused on a particular detail; some of them are accessible to the public and some of them are only available through consulting services. A preliminary comparison of some of these frameworks can be conferred at Niemann et al. (2008; 2009). The most notable ones are supplied by IBM, ORACLE, SAP, and SOFTWARE AG (Afshar 2007; Brown 2009; SAP AG 2007; Software AG 2005).

VALIDATION OF META MODEL

As mentioned earlier, the compared frameworks have different scopes and focus on different aspects of governance. This is reflected by the fact that some cells in the tables remain empty, i.e., the particular framework does not include the respective concept or aspect or at least does not elaborate on that aspect in particular detail. However, with the exception of Part C, the company-specific aspects, which we only included to provide the link to the operationalization or implementation of a governance framework, all the elements of our meta model can be found in at least one of the existing approaches. Processes, roles, and metrics are key aspects, artifacts, skills, and tools are secondary aspects. Concerning views we did find support for a primary and secondary process structures. KPIs have not been specified to the same extent so a secondary KPI structure is rare and we consider one KPI area type as sufficient an entity to reflect this. Similarly, maturity models and capability models can both be subsumed into the entity *maturity level model*. We acknowledge that a *maturity and capability level type* might be a more meaningful but bulky name. As mentioned above, we did not find any reference to Part C in the comparison except hints in the rollout method of the TEXO Governance Framework. However, we still believe that the mapping of best practices to the actual organizational structure is necessary. It is, however, a tertiary aspect of governance frameworks and should be covered in an accompanying method to apply the framework. Keeping in mind, that the focus of the meta model is to facilitate tool support for governance for organizations, this means that the meta model does not include any invalid concepts with regard to the set of frameworks that are established and proven in practice.

Completeness of the meta model is more difficult to show. The meta model was initially derived from a thorough analysis of ITIL and COBIT, refined in interviews with governance experts as well as two case studies. This approach indicates a certain probability that the most relevant aspects have been captured. Nevertheless, advancements in the knowledge base on Service Governance might well necessitate the introduction of further concepts in the meta model in the future. However, we did not find any aspects with meaningful instances in these frameworks that we have not covered. In future revisions, we may make *capabilities* or *states/ effects* more explicit in some form. For the time being we consider them either as a KPI or as a process area.

The meta model of the OASIS Reference Architecture Foundation may also require a more comprehensive mapping than this comparison which mainly focused on instantiated entities. Further analysis requires a sound *service science meta model* in order to be comprehensive, reproducible, and generalizable. Ferrario and Guarino (2008) have taken a first step into this direction but require validation themselves before proceeding.

The proposed meta model intends to create a foundation for advanced tool support and enable organizations to base the realization of their Service Governance regimen on best practice reference models such as COBIT and ITIL, which require careful analysis and adaptation when used in a real-world context (Knahl 2009).

CONCLUSION

IT Governance in general and, more recently, Service or SOA Governance in particular have become critical success factors for organizations. They establish the leadership and organizational structures and processes that are needed to ensure that business value is generated from the IT/SOA investments and associated risks are mitigated. Adoption of a governance approach by an organization can be a difficult endeavor. Among other things this is due to the fact that there are many potential governance frameworks to be chosen from and often no single framework, if left unmodified, can meet all the company-specific requirements that an individual organization might have. Motivated by this observation, we have presented a consolidated, generic meta-model that was informed by literature analysis as well as empirical insights from interviews with practitioners. The meta model consists of three clusters covering processes, roles, KPI, and other essential attributes, views and indicators, and company-specific information. Owing to its high level of conceptual abstraction and its rooting in well-proven IT Governance approaches, it is even generic enough to be not restricted to the particular perspective of SOA Governance. The meta model can help organizations understand and analyze existing frameworks and can be used as the foundation for the implementation of a support tool for deriving and customizing an organization-specific governance framework. Such a tool would support organizations in assessing their SOA maturity, perform benchmarking against best practices, learn from existing governance frameworks as well as customize or build an organization-specific SOA Governance framework.

The new contributions this paper has made are 1) the empirical validation of the proposed meta model based on an attempt to map nine major, vendor-independent IT and SOA Governance and Management frameworks to the meta model and 2) the comparison of these existing frameworks based on the structure imposed by the meta model. The first effort revealed that the meta model is able to capture all major concepts that constitute these existing frameworks. It also showed that in spite of the need to link the generic framework concepts to company-specific instances, none of the existing frameworks takes this aspect into consideration. The second effort produced a concise high-level overview of core features of the existing frameworks. For decision makers in organizations that have identified the need to adopt and customize a governance framework, this overview can

serve as a useful starting point for or input to the framework selection decision process. The generic elements identified by the meta model and used as comparison criteria can help the decision maker set clear high-level priorities with regard to the features required of the governance framework to be implemented in her/his specific organization, and the analysis of the existing frameworks facilitates the selection of the best suited candidate or even the mixing-and-matching of elements from different frameworks to build a customized solution.

Future work will include the implementation of a consulting support tool based on the proposed meta model and its extension for applicability in loosely-coupled IT service provisioning ecosystems and business network contexts with many inter-organizational relationships and distributed ownerships of resources, systems, and processes to be governed.

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